

WHITEPAPER

Transform the manufacturing value chain with APIs

How Airbus, Univar, and ABB digitally transformed with an API strategy

Table of contents

Table of contents

Executive Summary

Over the past few years, manufacturers have made significant improvements to productivity through methodologies like lean operations and Six Sigma. In the U.S., for instance, productivity of industrial workers has increased by 47% over the past 20 years. However, according to a McKinsey report, traditional methodologies that were once driving these gains are now seeing diminishing marginal returns. As a result, leading manufacturers are turning towards new disruptive digital technologies to reach their next horizon of performance improvement.

Industry and academic leaders agree that these new disruptive digital-manufacturing technologies will transform every link in the manufacturing value chain, from sales and supply chain, to factory operations and service. Digital connectivity among designers, managers, workers, consumers, and physical industrial assets will unlock enormous value and change the manufacturing landscape forever. This shift is expected to be so radical, that it is known as the fourth industrial revolution, or Industry 4.0.

To respond to this shift, manufacturers must fundamentally change how they operate. As technology enables digital transformation, there is a greater demand on IT to deliver and execute more projects on tighter deadlines and budgets. Historically, custom code and point-to-point integration was enough to connect various transformative technologies; but as the needs of the business evolve, the limitations of these approaches are becoming much more pronounced. Businesses looking to leverage new innovations, such as the Internet of Things (IoT) or Artificial Intelligence (AI), will need to collect, share, and process an extraordinary amount of data, faster than ever before. To deliver on the needs of the business, manufacturers must rethink their integration strategy.

MuleSoft proposes a new modern approach to integration, API-led connectivity. This allows manufacturers to build a digital platform that incites internal collaboration across the manufacturing ecosystem. When all functions within a manufacturer perform as a cohesive unit, every aspect of the value chain is simplified, cutting down on unnecessary, repetitive efforts and costs. Manufacturers can increase their level of service while focusing on capital-generating activities. This whitepaper examines the impact of Industry 4.0, showcases the benefits of API-led connectivity, and provides examples of how industry leaders have implemented this approach across each value chain activity.

Introduction

Innovation and disruptive technologies have been at the forefront of every industrial revolution: the invention of steam engines powering the first, the use of electricity in mass production during the second, and the emergence of computers in the third. This is no different with Industry 4.0. Manufacturers are now attempting to capitalize on intelligent production by leveraging new technological capabilities like IoT, virtual and augmented reality, advanced robotics, and additive manufacturing. But the emergence of these digital capabilities also brings new challenges for manufacturers; now manufacturers must implement the latest digital tools to fulfill increasing customer expectations and stay competitive in the market.

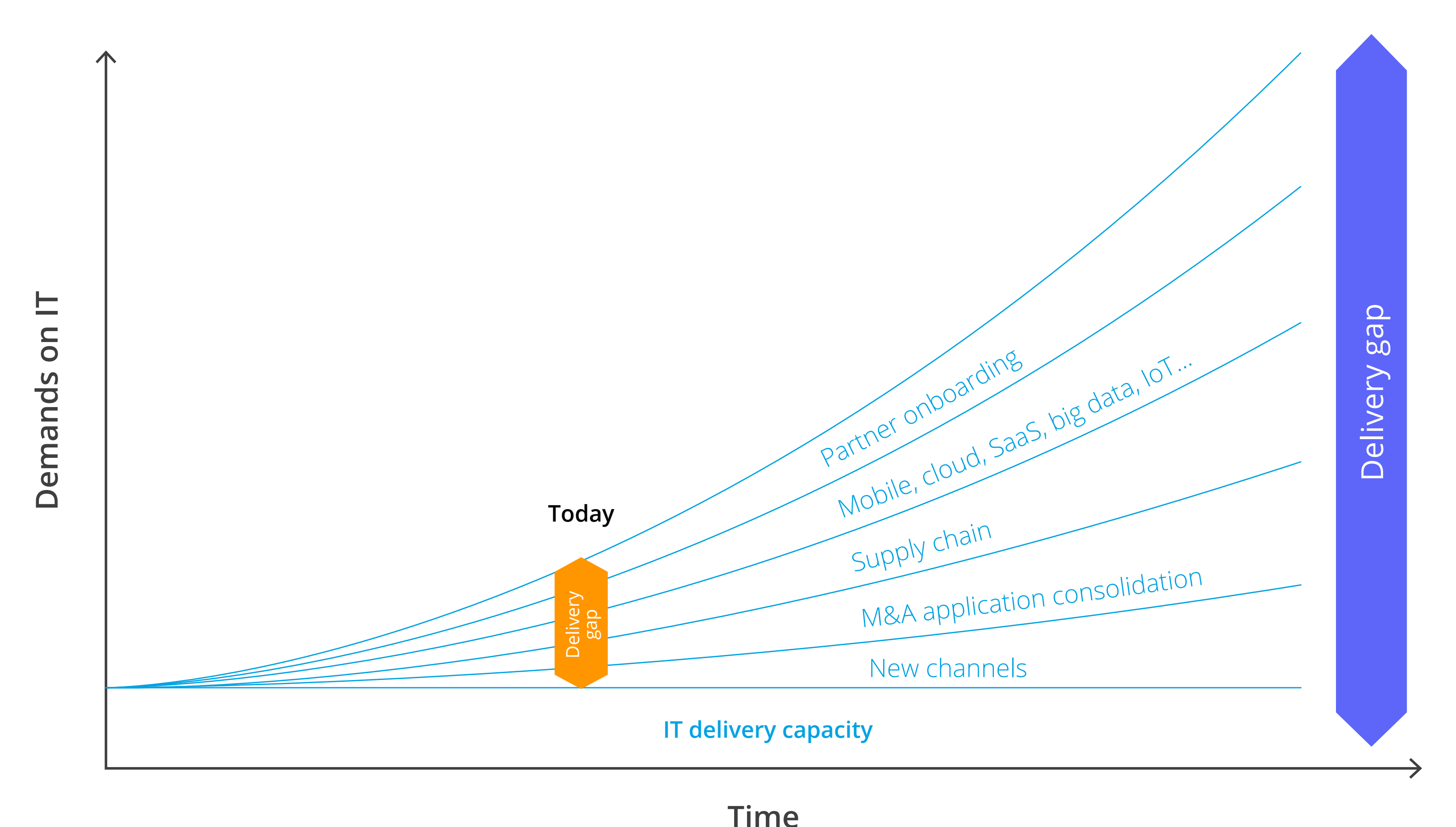
There are significant demographic shifts pressuring manufacturers to digitize their business. While Amazon is not typically viewed as a manufacturing disruptor, millennials and Gen Z have grown up in an era where every company should be doing business digitally. Customers now expect manufacturers to utilize the latest technology to provide better customer service. If not, they will take their business elsewhere. A survey conducted by the Manufacturing Leadership Council found that 85% of manufacturers agree that the pace and competitive importance of innovation are accelerating, and the largest group, 36%, say customer requirements and expectations are driving it.

The combination of emerging new technologies (IoT, AI, robots, etc.) and evolving customer expectations are creating conditions of an industry that is ripe for disruption. Innovative upstarts like Plethora, SpaceX, and Fictiv are gaining market share because of their ability to capitalize on the latest technological advancements, helping them find new ways to engage with customers and operate at lower costs.

Manufacturers are recognizing that they must shift their attitudes towards technology and adapt or risk being left behind.

Traditionally, manufacturers have been averse to technology adoption because it has been difficult to adopt and capitalize on its benefits. Manufacturing is a capital-intensive business with complex physical operations; if a manufacturer has to redo its shop floor or build a new plant, the lead time is lengthy and requires major capital investments. However, manufacturers are beginning to recognize they can no longer shy away from technology adoption simply because they are apprehensive about operational changes. Nearly 90% of manufacturing leaders surveyed by Boston Consulting Group recognize that adopting digital technologies can increase productivity and lower costs.

So when a manufacturer's leadership team looks towards technology to enable digital transformation, there comes a greater demand on IT to deliver and execute projects on tight deadlines and budgets. For example, as customer expectations increase, business executives will begin requesting a number of new digital initiatives, all of which must be completed with the utmost urgency: opening new revenue channels, consolidating applications from M&A, developing agile supply chains, implementing IoT, and improving new partner onboarding. This becomes increasingly more difficult to manage with current resources, causing the IT delivery gap to further widen over time.



MuleSoft believes that the secret to addressing this IT delivery gap lies in a well-thought-out integration strategy. In a traditional organization, IT teams must integrate systems on an as-needed basis. Because integrations need to constantly be rebuilt, it is difficult to gain visibility across the IT environment or even upgrade ERPs. Manufacturers recognize that this approach isn't sufficient. When correctly planned and implemented, a strong integration strategy can increase the speed at which IT operates and have dramatic improvements across the entire manufacturing value chain, for example:

- **Sell:** Quickly implement and integrate various siloed engagement channels to improve customer experience.
- **Execute:** Harness accurate forecasting data to more effectively inform planning and execution processes.
- **Distribute:** Provide customers and partners end-to-end visibility across the entire supply chain to track product development and shipment status in real-time.
- **Service:** Develop an agile and flexible architecture to enable manufacturers to develop new service capabilities.

This value chain shows which top business and IT initiatives are impacted and the systems that are involved.

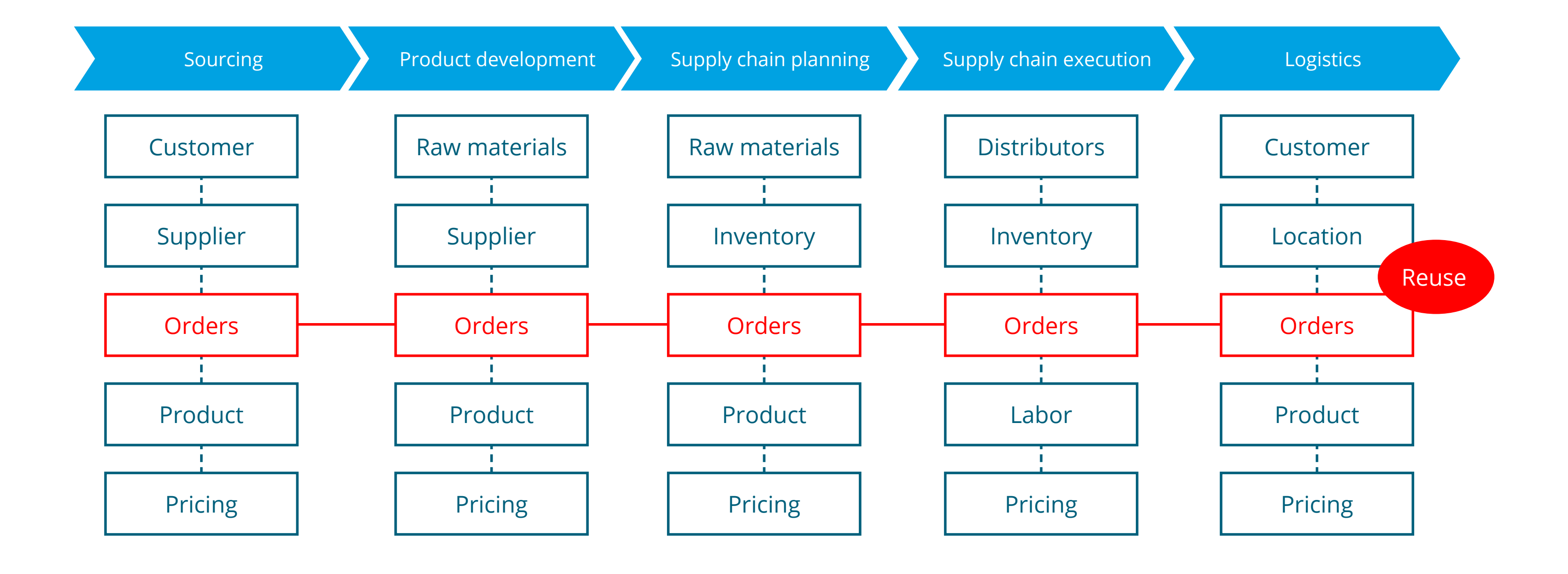
	Sell	Execute	Distribute	Service
Value chain activity	Prospect to contract	Order to product (planning and execution)	Logistics and product distribution	Product to service
Business initiatives	Product/service catalog management	Supply chain optimization	Logistics and distribution efficiency	Aftermarket services capabilities
IT projects	B2B commerce Order capture & sales agreements (purchase orders)	Inventory management Fulfillment management Quality assurance	Real-time product tracking On-Time Delivery	IoT driven service Service parts management
Systems involved	Purchase order management, ERP, financial systems	Order management, inventory management, warehouse management, S&OP, labor management systems, manufacturing execution systems (MES)	TMS, EDI technologies	ERP, customer data, product installment management, customer/ partner portals

Manufacturers are recognizing that IT cannot remain an order-taker for the business, but must transform into an innovation partner and strategic enabler for the business. To do so, IT must provide scale by facilitating reuse and allow other line of business IT teams to self-serve through an internal digital platform.

Integrate every step of the value chain with a digital platform

To avoid asset duplication and rework, manufacturers need to move from a siloed project-based approach to an internal digital platform strategy. The key is not to see each initiative as a separate project, but as one part of a collective series of projects. An internal digital platform acts as a repository, where everyone in the business (who has the right to know) can see what systems, data, and processes are available across the enterprise, driving standardization, scale, and innovation.

Building such a digital platform and enabling an internal shared services model can unlock unprecedented economies of scale. Various lines of businesses can develop and share services with other teams, driving increased leverage for each new product that is going to market. For example, a manufacturer's central IT can create core assets such as product, inventory, orders, pricing, and labor, then package these assets for reuse and self-service across different product lines. Rather than duplicating work across different teams, they can identify commonalities, build once and reuse across teams to launch new products to market faster. This reduction in IT friction frees up additional IT resources, who can now focus on other projects. By granting visibility and access to data and processes across the organization, manufacturers can eliminate the challenges that once persisted around organizational silos.



To drive effective adoption of this platform, organizations must drive parallel transformation in the mindset and behaviors of the teams on the ground driving the change. Organizations need to create a culture of inclusion and sharing. Line of business teams must give up “control” of “their” data, unlocking access to applications, data, and processes for the broader manufacturing ecosystem.

How might manufacturers look to transition towards an internal digital platform strategy?

MuleSoft has found that APIs are the key to success.

APIs enable the development of an internal digital platform strategy

APIs provide a standardized way to scale access to data and application logic across an ecosystem, enabling the same type of technology innovation that has catapulted the other darlings of the digital age to the top of their respective industries. Whether it is Amazon, Netflix, or Airbnb, API technology is invariably keeping their IT ecosystems bound together under the hood.

Given the foundational role that APIs play in the business models pioneered by these leaders, one key best practice has been to treat these APIs as full-fledged products, not just cogs in the organization's technical engine. This best practice should, in turn, be adopted by manufacturers looking to build a similar internal digital platform of APIs.

To build this out, MuleSoft proposes leveraging a new construct — API-led connectivity — which reimagines SOA for today's unique challenges and is a critical enabler for developing digital platforms. API-led connectivity is an architectural approach that shifts the way IT operates and promotes decentralized access to data and capabilities, while not compromising on governance. This framework for ordering and structuring APIs, comes from a multitier architecture containing three distinct layers:

- **System API Layer:** Underlying all IT architectures are core systems of record (ERP, key customer and billing systems, proprietary databases, etc.). These systems are not easily accessible due to connectivity concerns, and APIs provide a means of hiding that complexity from the user. System APIs expose that data, often in a canonical format, while providing downstream insulation from any interface changes or rationalization of those systems. These APIs will also change more infrequently and should be governed by central IT.

- **Process API Layer:** The underlying business processes that interact and shape this data should be strictly independent from the source systems where that data originates, and the target channels through which it is to be delivered. For example, in a purchase order process, there is some logic that is common that can, and should, be distilled into single services and can then be called by product, inventory or order history parent services. These APIs perform specific functions and provide access to non-central data. These APIs can be built by either central IT or line of business IT.
- **Experience API Layer:** Data is now consumed across a broad set of channels, each of which wants access to the same data but in a variety of forms. For example, a B2B commerce site and mobile application may all want access to the same customer information fields, but will require that information in a different format. Experience APIs inform and interact with a presentation layer specific to a unique business context; this provides a means to render pre-formatted data in a way that aligns to a specific audience and context so that the data can be easily consumed and acted upon to align with the intended business scenario.

In the following sections, we will discuss how IT teams can leverage an API-led connectivity approach across each process within the value chain.

Benefits of API-led connectivity across the manufacturing value chain

I. Sell

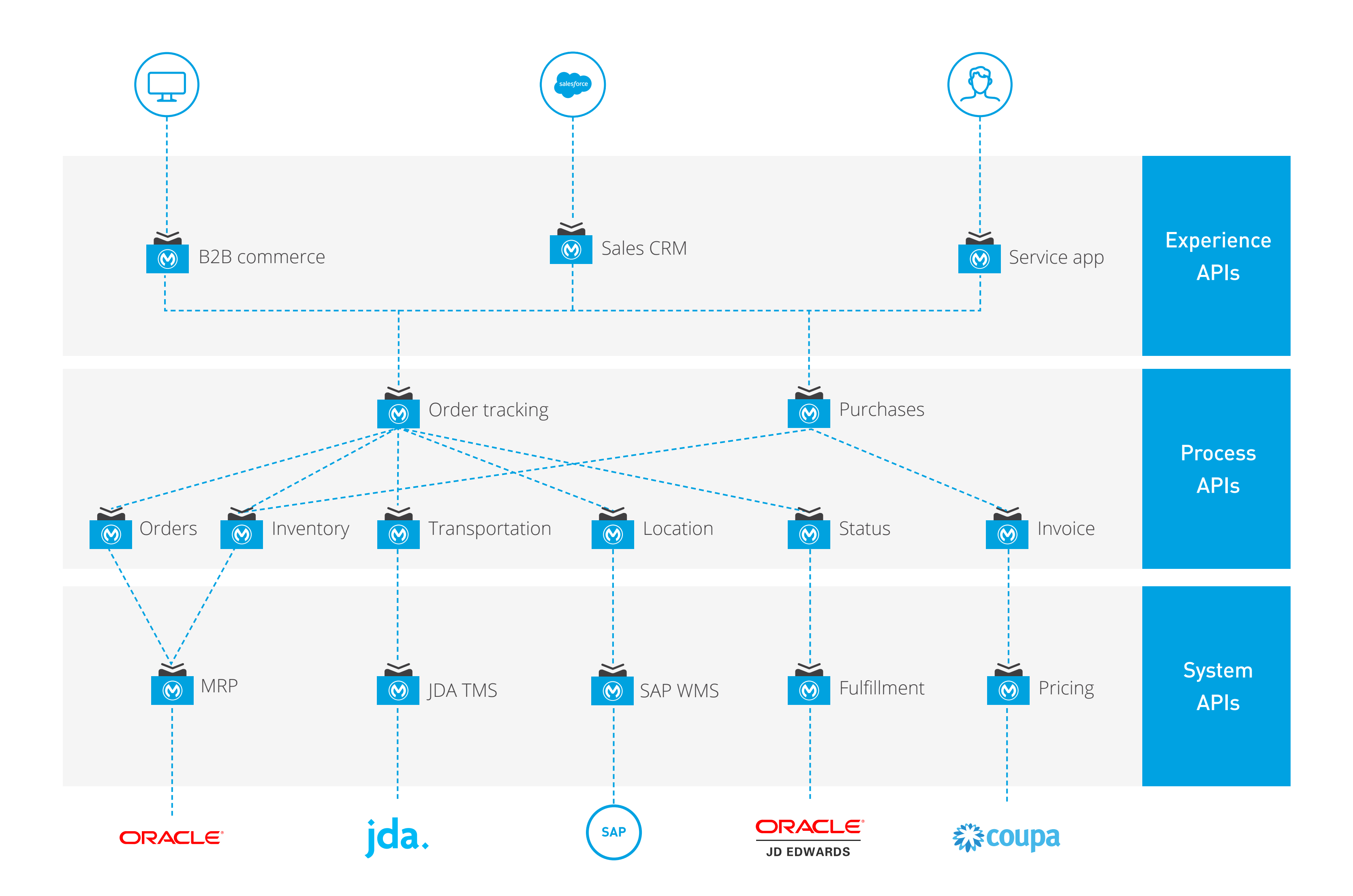
Manufacturers are now opening up new digital channels as a means of further engaging with their digitally-enabled customers. Customers now expect manufacturers to be channel-agnostic across both online and offline channels. Even though most customers would rather make their purchases online, if they were to call the customer service representative (CSR), they expect the service agent to see the orders they just made online. Thus, manufacturers are attempting to create a more connected customer experience across all channels.

As more channels and applications are introduced, the status quo of custom coding integrations simply isn't scalable. They are brittle, expensive to maintain, and not designed for change. When implementing a new system, such as B2B Commerce, a developer often builds and manages integrations by writing custom code. However, any code changes may impact other systems, leaving room for errors and downtime. So while custom coding integrations may deliver a short-term solution, it becomes overly complicated as the business grows.

Let's see how API-led connectivity would be applicable when tasked with these two IT projects:

1. **Implement a new engagement channel such as B2B commerce:** To ensure customers have a seamless check-out and purchasing experience, IT must integrate the new B2B commerce platform to backend systems holding pricing and fulfillment data without any downstream disruption. Since systems and applications are often set up in silos, there can be challenges untangling a tightly coupled architecture.

2. **Expose accurate, real-time data for sales teams and CSRs:** Since there are multiple channels to procure products, real-time inventory data needs to be up to date so sales teams don't sell a product that is unavailable. This requires IT to provide real-time connectivity between backend systems and all new distribution channels.



› **System API layer:** System APIs unlock key systems of record that hold data such as manufacturing resource planning, transportation management, warehouse management, fulfilment and pricing. This creates a layer of abstraction, so teams cannot create downstream disruption because they do not have direct access to backend systems.

› **Process API layer:** Process APIs enable line of business IT teams to reuse previously created assets rather than surfacing data in silos. By reusing APIs created by central IT,

it is easier to ensure sales and service teams have access to accurate real-time data across pricing and inventory levels.

- **Experience API layer:** Experience APIs allow teams to extrapolate data from backend systems without needing to understand how it got there. So rather than building separate integrations, IT can leverage the order tracking and purchasing APIs to pull data into their new B2B commerce platform. By decoupling their architecture, manufacturers create reusable building blocks that will accelerate implementation timelines.

Let’s take a look at how Univar Solutions (formerly known as Univar) uses MuleSoft’s Anypoint Platform to support its selling process.

Case study: Univar Solutions

Univar Solutions is a leading global distributor of specialty and basic chemicals. With 800 distribution facilities and a network of 8,000 producers worldwide, Univar Solutions relies on its operational excellence to provide customers with reliable deliveries, while offering cost competitive products. It operates in a heavily-regulated environment, sells entirely B2B, and has grown heavily through acquisition.

Univar Solutions was grappling with shifting customer expectations — B2C experiences were influencing expectations in the B2B world to deliver seamless and consistent interactions. As Univar Solutions looked to transform its commerce experience for its customers, its current infrastructure couldn’t fulfill the demand needed to run an advanced B2B commerce site.

Its 30 year-old on-premises ERP wasn’t built for internet scale and was disconnected from its host of cloud applications. This made it difficult for IT to quickly implement change and paralyzed the business’ ability to respond to changing industry trends. Additionally, its current commerce site was a hosted software application that was consuming massive resources for upgrades and only offered basic transactional capabilities for customers. After enduring a 14-month upgrade to its legacy site, the team had enough and decided to search for a new

platform. However, they knew they would also need a better integration strategy to support this new commerce platform.

Univar Solutions selected Salesforce's B2B Commerce Cloud as its e-Commerce solution. While this modernized its front-end experience, it also had a plethora of acquired cloud solutions and a 30-year-old mainframe ERP that was the system of record for critical product data. Univar Solutions' IT team knew that if they continued to build point-to-point integrations, they would continue to face scalability challenges in the future. Thus, they began adopting an API-led connectivity integration strategy with MuleSoft.

With MuleSoft, Univar Solutions now exposes APIs to cloud applications securely, reduces synchronization issues, and makes its data easily accessible to the development team. By building a foundation of reusable assets, Univar Solutions went from contract to a live e-commerce site in just eight weeks. Over the next 12-months, Univar Solutions was able to expand into a new region, Canada, which historically had no e-Commerce presence. By leveraging templates and patterns provided by Univar Solutions' central IT team, Canada's IT team was able to build out the new region's IT environment faster than planned and without any downtime.

API-led connectivity provided Univar Solutions with an agile, adaptable approach to integration. It is now able to provide its customers with real-time pricing and inventory data, while ensuring its IT environment is prepared for future scale. By leveraging prebuilt assets, Univar Solutions can quickly bring commerce capabilities to new engagement channels and regions. Univar Solutions continues to outpace the competition through innovation and exceptional customer experience.

II. Execute

Today, planning and execution is more data driven than ever. Advanced analytics and artificial intelligence give manufacturers the ability to draw new insights from large datasets. However, few manufacturers are able to harness and comprehend it. Forrester states that on average, between 60% and 73% of all data within an enterprise goes unused. In an industry where a 1% improvement in productivity can result in $500 million in

annual savings, harnessing these data insights is critical to cost savings. As a result, manufacturers are investing in technologies that will help them leverage data insights to improve efficiency and cost reduction within their supply chains.

Data intelligence is challenging because data is captured in silos. The increasing number of applications and data sources in a manufacturer's environment is leading to a growing proliferation of raw data. For example, forecasting data is captured in ERPs, spreadsheets, forms, and data warehouses, making it difficult for executives to have accurate sales data. Manufacturing is a capital-intensive business, requiring a big investment in raw materials, plant capacity, and labor. Thus, accurate forecasting and strategic planning, along with the mechanisms to meet those forecasts, equates to more predictable business performance. Without these mechanisms in place, there can be major production issues due to poor planning.

In the execute phase, manufacturers are looking to optimize their supply chain by having better financial management, cost control, and less organizational waste. IT needs to figure out how to make sense of the siloed data stored in various cloud applications and on-premise legacy systems. However, this can take weeks to get the right analysis to begin execution because they need to synthesize information from a variety of systems, for example: ERP, product information management (PIM), warehouse management, labor management, and manufacturing execution systems.

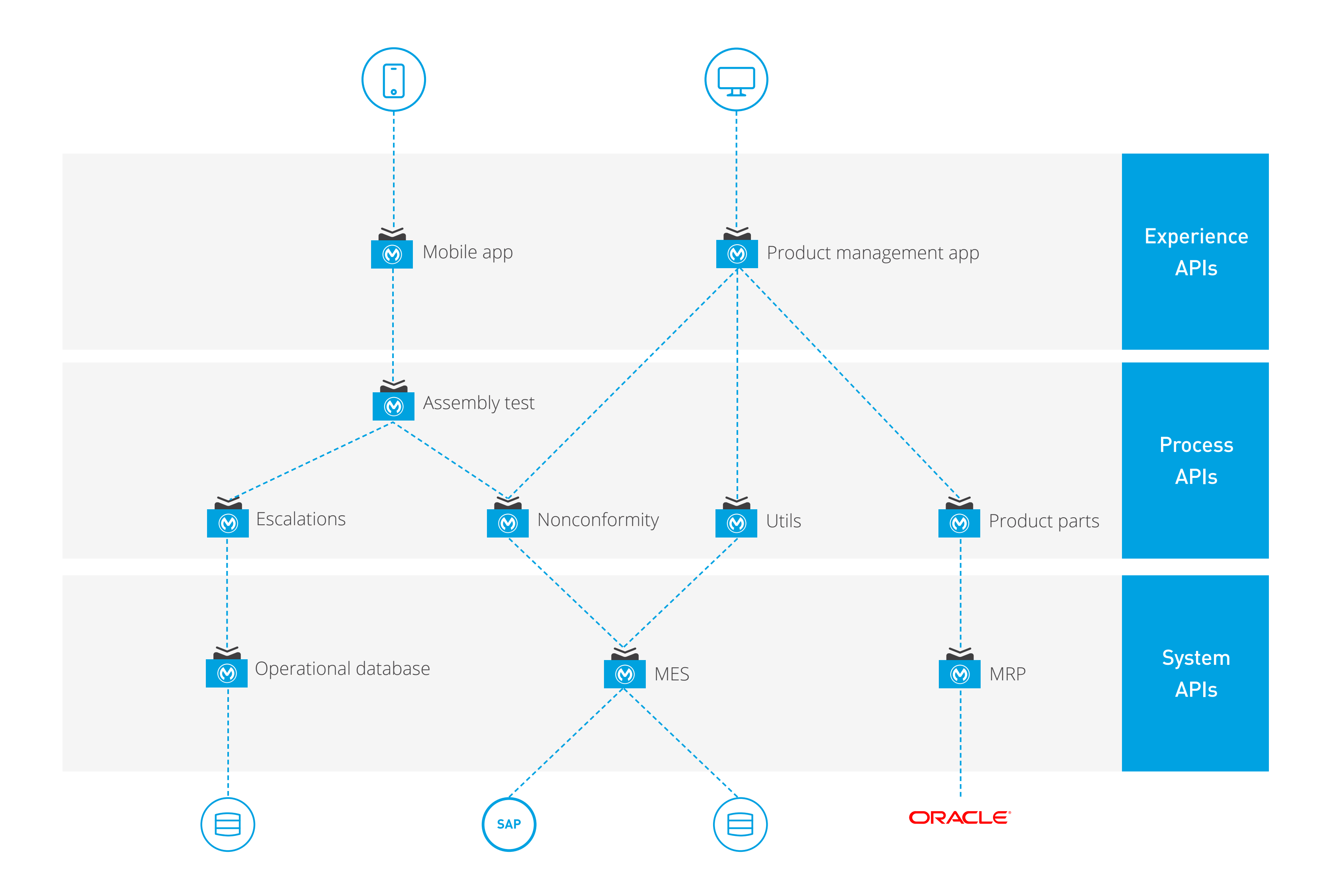
Let's see how API-led connectivity would be applicable when tasked with these three IT projects:

1. **Create an application to track projects surrounding product development:** This enables people on the plant floor to gain real-time feedback on how their actual work compares to planned output. They can then more

accurately predict when various parts will be ready for final product assembly.

2. **Inventory optimization:** IT needs to find a way to integrate real-time material availability with real-time manufacturing capacity. This will help create the optimal amount of inventory and eliminate any excess and obsolete product.

3. **Improve product quality:** To ensure quality standards are being met, IT is asked to enable employees to quickly detect anomalies by assessing component and asset performance.



- **System API layer:** System APIs wrap key data sources as a means of abstracting raw datasets and creating downstream insulation when additional applications are brought into the ecosystem. As teams build out new mobile or product

management apps, they can retrieve key data without directly accessing the MRP or MES.

- **Process API layer:** Process APIs provide business meaning to the raw data sets. Teams can then actively work together and share information, such as data on product parts, to ensure inventory optimization and production efficiency.
- **Experience API layer:** Experience APIs are the means by which data can be reconfigured so that they are most easily consumed by their intended audience, all from a common data source, rather than setting up separate point-to-point integrations for each channel. This allows plant floor operators to track projects surrounding product development through an app and quality assurance teams to detect anomalies by assessing asset performance on a mobile device.

Let's take a look at how Airbus uses MuleSoft's Anypoint Platform to support its execution process.

Case study: Airbus

Airbus is a commercial aircraft, space, defense and helicopter manufacturer. It is the largest aeronautics and space company in Europe and a worldwide leader in the aviation industry. With about 25,000 daily flights, Airbus aircraft are taking off or landing every 1.4 seconds. To meet the needs of the growing aviation industry — expected to double customers in the next 15 years — Airbus needed to significantly ramp up aircraft production while decreasing costs and improving efficiency in a sustainable way.

Airbus needed to address two primary challenges. One, how to scale its manufacturing process? Second, how to continue to innovate and improve customer experience while keeping in mind the economies of the aircraft? Airbus recognized innovation fell throughout the manufacturing process, both in how the aircraft was built, the raw materials, and the technologies used along the way. For example, an Airbus 380 is made up of 7 million different pieces, with each piece coming from different parts of the world. This includes the vertical

stabilizer coming from Germany, the horizontal stabilizer from Spain, wings from the UK, and engine pylons from France. The pieces are sent to the final assembly line where workers put the entire plane together. Leveraging legacy supply chain technology to support on-time arrival and coordination of parts was incredibly challenging because it did not provide real-time insights across various teams. The team recognized that this would only worsen with the businesses' massive growth. Thus, they needed to think through how to drive innovation throughout the supply chain.

Airbus needed to adopt new technologies that would enable the company to be agile and secure, while delivering new solutions to market faster. To meet this goal, Airbus formed a team within the IT department called the "Digital Accelerator," with the sole mission of applying digital technologies to transform the way Airbus builds aircraft. One of the Digital Accelerator's first decisions was to implement the Anypoint Platform to drive digital transformation by enabling an API-first strategy across the organization.

To help scale operations, Airbus' IT team built APIs on Anypoint Platform, putting critical data into the hands of employees on the front lines. During transport to the final assembly line, parts are at risk of being damaged. To track this, shop floor operators had previously relied on physical workstations to document. These workstations were often at the opposite end of the shop floor, meaning they could not be in front of the issue when entering information on the damaged part. The constant back-and-forth from workstation to shop floor — plus the fact that the production team did not have a real-time, consistent view into their projects — caused significant delays in the manufacturing process.

Using Anypoint Platform, Airbus' IT team built a nonconformity API. This API pushes data into an application that shop floor operators can access from their personal mobile devices to gain real-time visibility into parts and projects. This nonconformity API could also provide real time updates to the supply chain logistics team allowing them to find the right replacement part faster in their inventory, hence speeding the whole manufacturing process end to end. Airbus unlocked data from cloud and on-premise systems — including multiple SAP systems like SAP S/4 HANA and Skywise, a customer big data platform — bringing this valuable data together to reduce time to market of new aircraft production.

By easily developing and reusing APIs through Anypoint Platform, Airbus streamlines the development process and cuts time to market for IT services. Now, they are reducing time to market by delivering projects in four to six weeks, compared to what used to take them four months. “We can now use that data, transform it, which enables us to have insights into events on the supply chain and how we manufacture the aircraft,” said Chris Taylor, VP of the Digital Accelerator team. As the Digital Accelerator grows, Anypoint Platform will play a critical role in enabling developers to onramp quickly, discover, and reuse assets to deliver projects faster.

III. Distribute

There is a “new normal” when it comes to operational excellence as manufacturers are expected to have an integrated, visible, and efficient supply chain that provides partners and customers access to track product and shipment statuses. To adjust, the business depends on central IT to deliver on the technological infrastructure needed. However, managing an effective distribution process is difficult and complex. Most supply chain operations involve integrating various siloed systems and are dependent on outdated technology standards like EDI. IT teams often have to resort to custom solutions to bridge the gap, creating a backlog so great that IT loses the capacity to deliver solutions on time.

As manufacturers’ supply chains become more international, complex and dynamic, there are more tools and data that need to be connected, a problem that falls squarely into IT’s lap. There are two IT initiatives that are proving particularly thorny for businesses looking to modernize their supply chain logistics operation:

- **Providing real-time visibility into all order and shipment details for customers:** Most manufacturers and distributors receive a number of calls from customers asking, “Where is my order?” Because systems are often

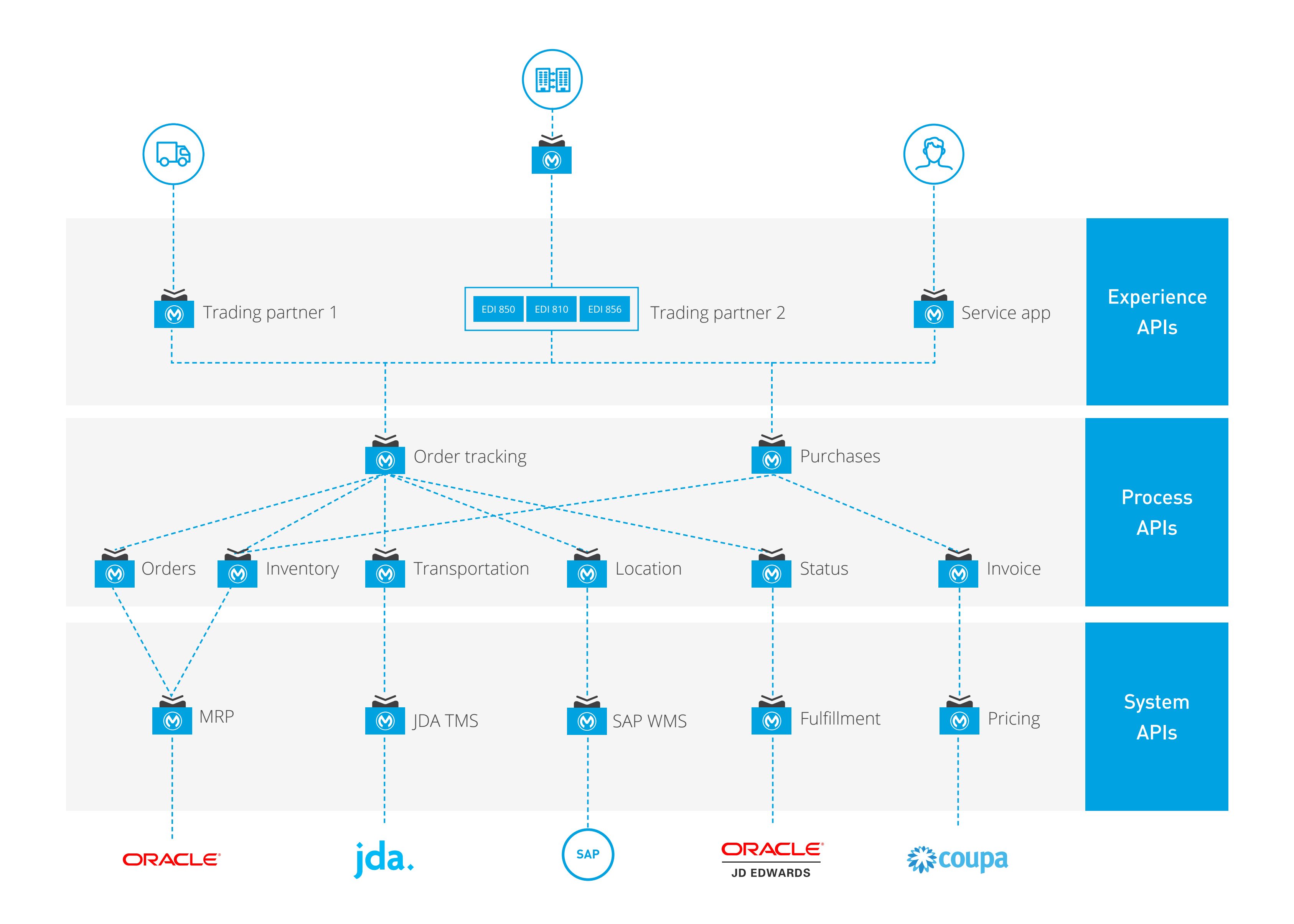
operated and set up in silos, it is difficult for a service agent to access the appropriate tracking information for shipments. Often the agent will need to call a number of teams before the appropriate information is trickled up to the service agent and given to the customer.

- **Decreasing partner onboarding time (partner setup, message mapping, business logic):** When businesses start working with partners, B2B/EDI partner setup, trading profile management and message processing are core to the onboarding process. This onboarding can take a significant amount of time, often weeks to months. In the case where such work is outsourced to a VAN provider, it becomes a black box. New partners may ask to conduct business through APIs versus EDIs. If the current system is not setup to handle both EDI and API partner transactions, IT teams may need to build a custom solution, increasing partner onboarding times. In a world where speed is a competitive differentiator, shaving time off the partner onboarding process is critical.

To meet customer demands, logistics data needs to be interoperable and processed in real-time. In addition, having this data visible to the analytics teams and other lines of business is also important. Manufacturers need to find a robust integration solution to provide visibility into both frontend and backend systems. This increases productivity and simplifies business processes, resulting in a more visible supply chain.

So how does a manufacturer improve its distribution processes? MuleSoft proposes a holistic integration strategy, API-led connectivity, to obtain operational excellence.

This provides both the flexibility to work with different partners and allows manufacturers to retain control over core ERP systems. As an example, here is a diagram of how API-led connectivity works to modernize the distribution processes:



- **System API layer:** System APIs unlock data from Oracle, JDA, SAP, Oracle JDE, and Coupa.
- **Process API layer:** These build on the system APIs by combining and streamlining inventory data from multiple sources into, for example, an order tracking API. This information can now be shared with multiple line of business teams to provide end-to-end visibility across the supply chain.
- **Experience API layer:** Finally, experience APIs are built to bring together the orders, transportation, location, inventory, and status data, specifically needed by trading partners and service applications. This provides the ability for service agents to address customer asks around product tracking. Furthermore, because Anypoint Platform is a single platform that supports APIs, integrations, and EDI, companies can quickly set up backend integrations to support the onboarding process for new partners.
  In pursuing this approach, manufacturers can abstract the complexity of integration and focus on delivering the end user experience.

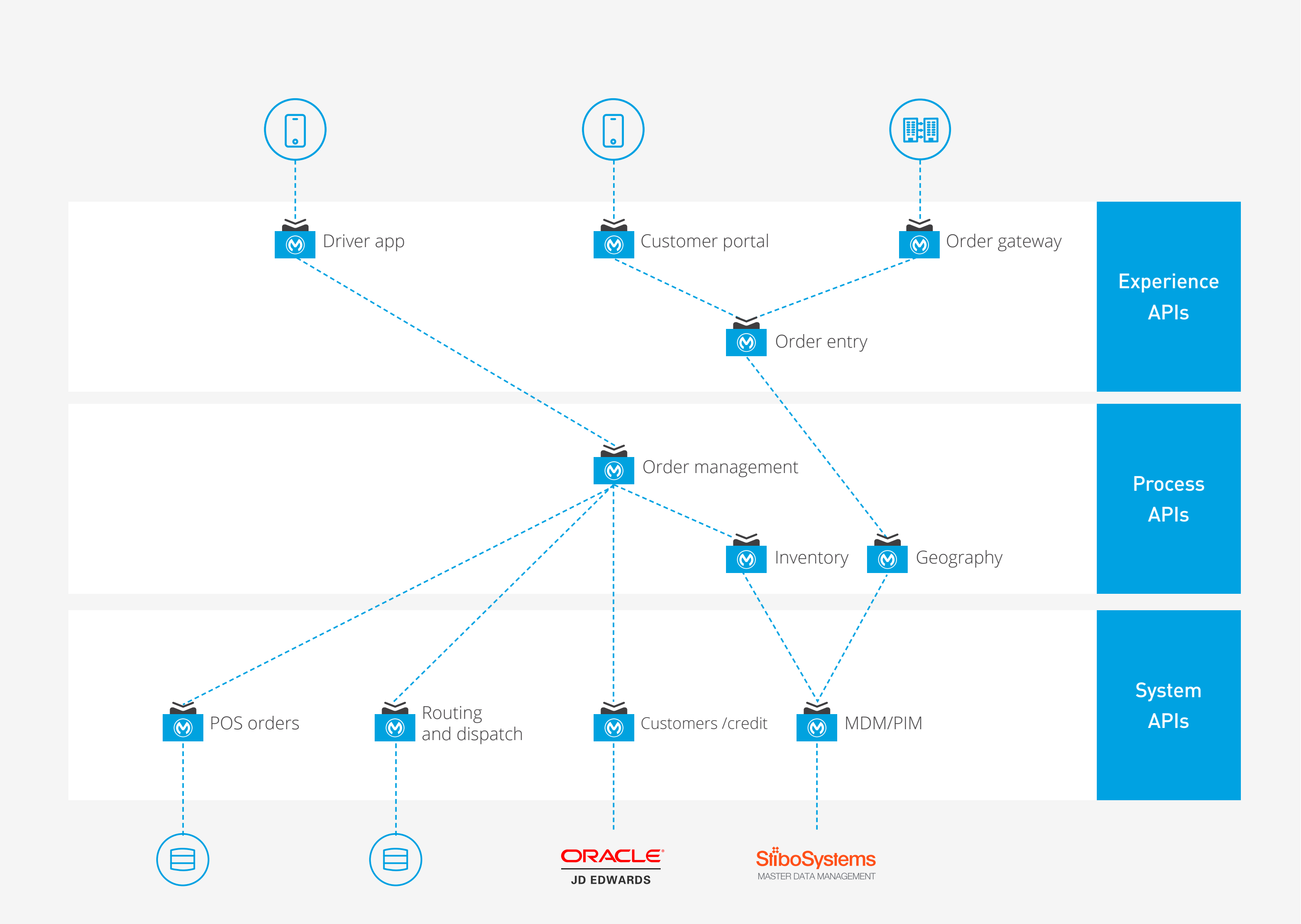
To see an example of a robust, holistic integration strategy creating dramatic business outcomes, take a look at how a large wholesale distributor uses MuleSoft's Anypoint Platform to bolster its distribution process within its supply chain.

Case study: Large Wholesale Distributor

One of the United States' largest wholesale distributors of siding, windows, exterior building products, tools and related supplies was looking to expand its product portfolio through an acquisition growth strategy. This allowed it to gain more market share and a bigger and more diverse customer base. However, throughout the years, it recognized that its customer populus was changing and expecting the ability to access information anywhere, anytime. It identified supply chain modernization as a key lever to help enhance operational efficiency and improve customer experience.

IT was tasked with turning these initiatives into a reality. They knew that their current custom code approach to integration would not allow them to scale at the speed the business needed. They needed to find a solution that would accommodate the needs of future acquisitions as there would be an imminent need for application consolidate and migration. To address this, the distributor decided to build on MuleSoft's Anypoint Platform and take an API-led connectivity approach to drive reuse throughout the organization.

To improve customer experience, the IT team built APIs that put valuable customer and order data into the hands of employees. The distributor had a number of sales channels to purchase its products, meaning branch personnel would need to re-key orders from various channels into a single system. This made it difficult to efficiently validate orders in a timely manner. Thus, the IT team built a number of APIs focused on customer, order, product, and POS data. This provided a consolidated view that validated orders coming from three different sources: quoting, e-commerce, and EDI. IT then leveraged the same APIs to develop a connected driver app that streams real-time information from 5,000 trucks on the road. Drivers can now push real-time shipment status updates into their customer portals, while customers can easily log in and see real-time arrival updates. This has led to fewer customer support calls, reduced customer friction, and improved employee productivity in its distribution process.



API-led connectivity provided compounding benefits with every project completed. By building the majority of the APIs with the first project, the IT team was able to reuse those core assets in projects two and three. "With MuleSoft, we were able to deliver projects 4x faster. We went from being the team others were waiting on, to the one waiting on other teams to complete implementing," said its manager of architecture and integrations. Looking ahead, this distributor hopes to continue its digital transformation by continuing to drive reuse through its modern application architecture.

IV. Service

Smart products combine the physical and digital world, providing manufacturers with new business opportunities. More manufacturers are moving into the as-a-service market by enhancing the product portfolio to deliver value-added services on top of the core product.

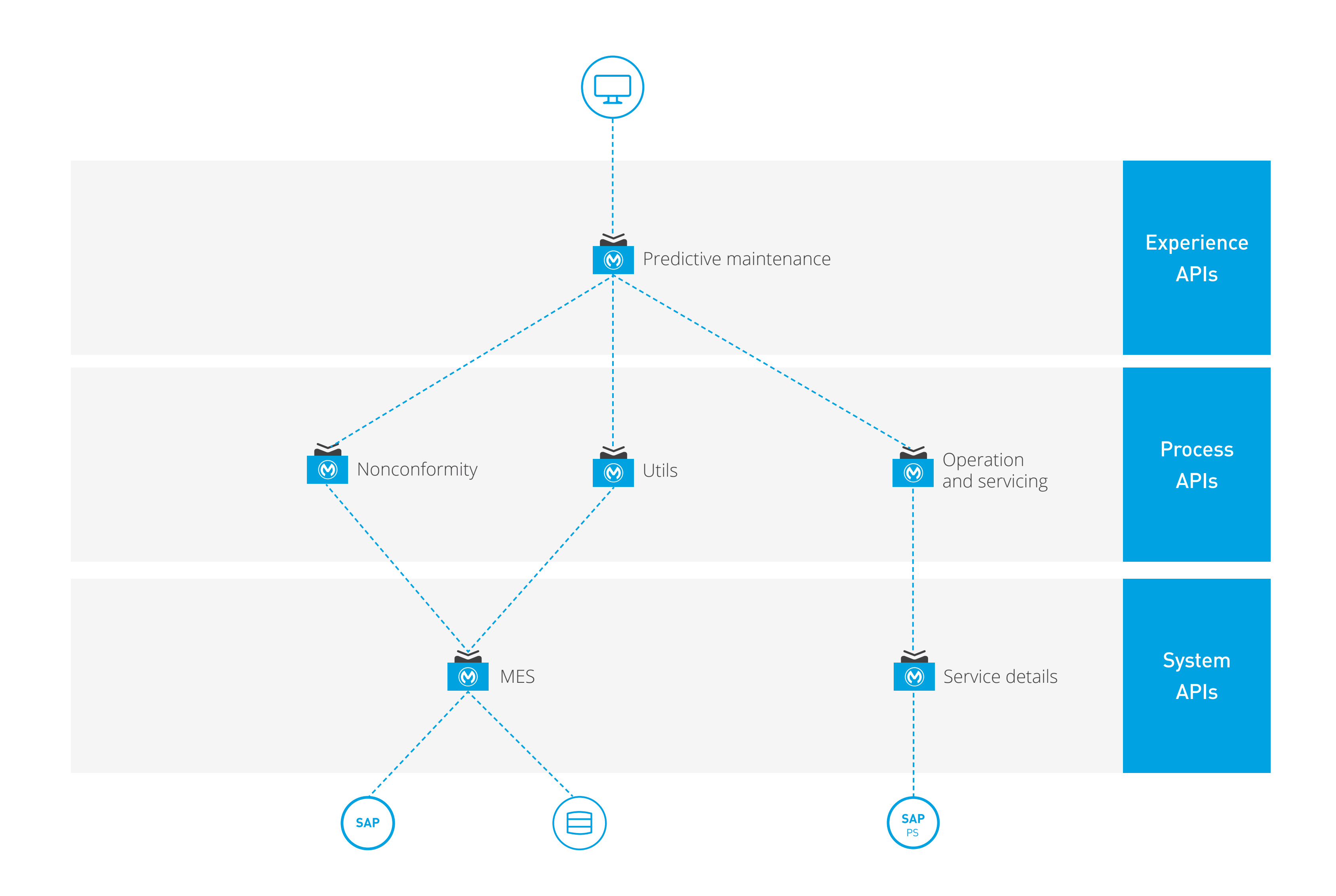
To some, this means the ability to manufacture highly customized, made to order products. In consumer electronics, this could mean exact-fit headphones, custom-colored keyboards, or even customized electric razors. To others, this could entail creating products that provide ongoing value to the customer by manufacturing built-in sensors into IoT devices. For instance, John Deere has satellite-connected guidance systems, which provides operational functions that help John Deere and its customers analyze field performance. "We're trying to pull all the data together, from different machines in different locations, then...analyze the data and generate insights that will allow farmers to make better, more effective decisions," noted Georg Larscheid, integrated solutions implementation manager at John Deere.

These functionalities give customers a better experience, as well as enable manufacturers to better understand their customers' needs. Thus, manufacturers are increasing investment in aftermarket services. This includes creating connected service operations, which gives manufacturers the ability to build connected products and services. As a first step towards building connected services, many manufacturers look to create remote condition monitoring (RCM) capabilities. Manufacturers can then access status information in real-time, provide support services, and quickly detect the root cause analysis for product failure. Ultimately, this is to ensure customers experience no downtime while using their products and to allow manufacturers to make the transition from manufacturer to service operator.

Again, the onus is put on the IT team. IT is now challenged with managing and integrating remote connections across hundreds of thousands of devices. This challenge is further amplified as manufacturers may have thousands of product categories, each with a different RCM solution. Thus, a manufacturer must ensure its integration strategy is agile, flexible, and designed to support future growth.

As discussed earlier, point-to-point integration is not scalable and cannot accommodate these increasingly complex use cases. In contrast, let's take a look at how API-led connectivity can be applied to an RCM use case.

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As discussed earlier, point-to-point integration is not scalable and cannot accommodate these increasingly complex use cases. In contrast, let's take a look at how API-led connectivity can be applied to an RCM use case.



- **System API layer:** System APIs unlock data from heavyweight legacy backend systems.
- **Process API layer:** Process APIs take core assets and combine them with business logic to create a higher level of value like nonconformity or utils to quickly detect product anomalies.
- **Experience API layer:** Experience APIs, such as the Predictive Maintenance API, allows app developers to quickly innovate by consuming the underlying assets without having to know how the data got there. Now other line of businesses can leverage this new capability within other product lines.

As these areas of inefficiency are eliminated, companies are better able to increase their level of service while focusing on capital-generating improvements and assets. Let's take a look at how ABB is using MuleSoft's Anypoint Platform to bolster its service strategy.

Case study: ABB

ABB, a $35B Fortune 500 manufacturing giant, is a pioneering technology leader who provides a wide variety of products and engineering services. With 130-years of experience, it has operations in more than 100 countries with over 150,000 employees.

The IT team faced challenges with both the volume and type of demands coming from the business. IT was expected to keep core backend systems and infrastructure running, but also implement new innovative IT initiatives surrounding IoT, AR/VR, big data, and advanced data analytics. ABB's data integration capability was managed by central IT, but the ownership of data was decentralized and distributed across the organization. This federated model created a bottleneck when new integrations or access to data was needed. IT recognized that their current way of integrating would not be conducive of future growth. They decided to leverage MuleSoft's Anypoint Platform to build an organization that would support API reuse and simplify access to data.

ABB decided to pilot this new approach via its RCM initiative, which was looking to add RCM to the millions of drives it manufactures each year. Historically to deliver an RCM for a single device, there were 56 manual steps that had heavy data dependencies coming from multiple backend systems. Rolling RCM across millions of devices would not be feasible due to the complexity and manual work necessary; which is why — despite manufacturing millions drives a year — only a fraction of those were connected devices prior to rolling out this initiative.

By leveraging an API-led connectivity approach, ABB has dramatically simplified this process. On the System API layer it unlocked data from the backend systems. On the Process API layer, business logic has been added to create internal and external customer account APIs. Finally, on the Experience API layer, a single API for Remote Condition Monitoring was created. This API would then be leveraged across every ABB drive.

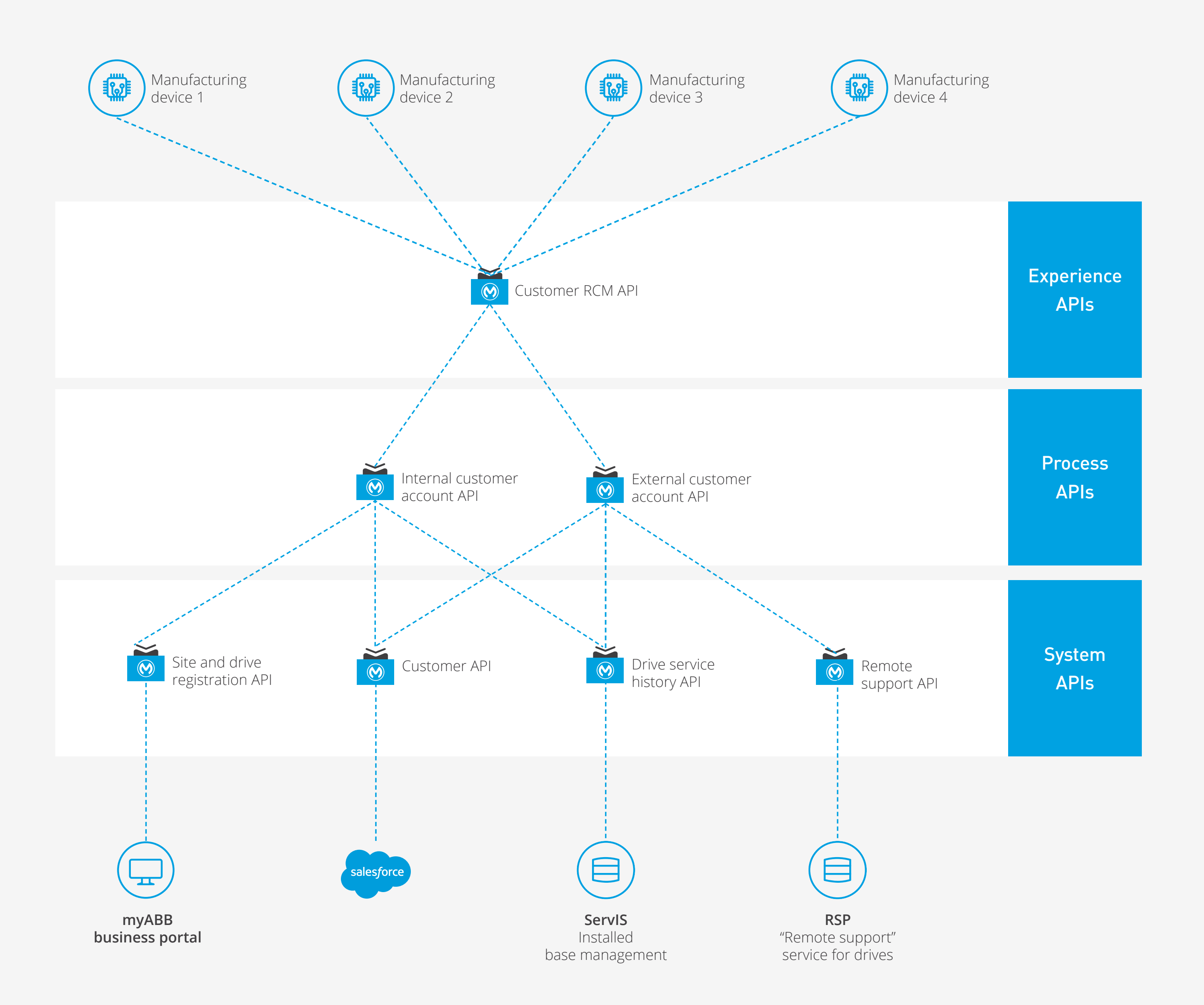


ABB will soon be able to provide data on the condition of a device, which will give additional value to its customers. "This new service, which uncovers opportunities for improvement that save both time and money, is the best way to move towards an information-based maintenance strategy," says global service manager Jaana Kivelä. The service will be able to spot overheating, which could cause unplanned production breaks and eventually damage the drive. ABB also recognizes that this RCM API has unlocked unprecedented economies of scale. The company can reuse this API for virtually any of its product.

Building APIs on Anypoint Platform, ABB streamlines the development process and cuts time to market for new services. This has enabled the business to deliver on projects like RCM 25% faster. The IT team also found that each API they built was reused across three to four additional projects across the organization. As ABB continues to push the envelope on innovation, Anypoint Platform will enable developers to onramp quickly and deliver new innovative services faster.

MuleSoft's four-step strategy for building an internal digital platform

Based on our experience partnering with 1700+ organizations, we recommend a four-step strategy for effectively building such a platform and maximizing the value it creates for business.

Step 1: Establish your digital strategy

Counter-intuitively, building APIs is not the first step toward establishing a successful internal digital platform. In fact, some have found that by rushing straight to development before aligning on overall digital strategy, the API platform that IT builds does not end up driving the intended business outcomes.

Instead, MuleSoft recommends that organizations start by establishing an overarching digital strategy.

First, align on what business challenge the API platform needs to solve. For example, improving customer engagement by delivering a consistent experience across all mediums will call for a different type of enabling digital platform than if the goal was to rapidly launch new products and build new revenue channels.

After alignment on the business challenge, organizations must align on how its digital strategy will support that challenge.

Once the business challenge and platform solution are clearly defined, both line of business and IT must align on the target audience for the digital platform they design. This audience must be kept top of mind when designing, sharing, and updating the APIs supporting your digital platform.

Step 2: Align organization and culture

For many, APIs represent a paradigm shift in how the business meets its objectives and how IT delivers projects. Ultimately, the people in your organization responsible for driving this shift will play a much more significant role in success or failure than any technology implementation considerations.

This is why it's so important to instill an API-driven culture. It starts from the top: organizations that can obtain and evangelize an executive mandate for the use of APIs will ultimately be much more successful at implementing this type of culture. One need look no further than the now infamous "Bezos Mandate"–where Amazon CEO Jeff Bezos dictated to his internal development teams that "All teams will henceforth expose their data and functionality through service interfaces." Because of this, APIs have been a fundamental driver of business model transformation at Amazon over the past 15 years, playing a significant role in its rise to market dominance.

For your digital strategy to succeed, APIs cannot be viewed as just cogs in the organization's technical engine. Regardless of the scope of exposure to the manufacturing ecosystem (whether APIs are being offered to internal consumers, external consumers, or both), they are treated as full-fledged products unto themselves.

Typically, for example, when a company offers some product to its customers, that product has to:

- Be designed with the intended customer in mind.
- Be packaged and marketed in a way that attracts targeted customers.
- Provide the customer with a great experience that inspires confidence in the brand.
- Be backed by guarantees it will work as advertised.
- Come with whatever support is necessary when customers have problems.

Furthermore, it is not enough for organizations to merely increase its use of APIs. A more API-centric operating model introduces a new set of security considerations, with APIs introducing new surface area for malicious hackers to attack. This, in turn, calls for a corresponding cultural shift that allows for organizations to take advantage of the benefit APIs can provide without increasing the risk of compromising trial or subject data. Organizations must prioritize trust, security, and privacy as organizational values, and back up its commitment to these values through investment in security technologies, such as vulnerability detection, threat prevention, and data-loss prevention. These technology investments, in turn, must be supported by strictly enforced security best practices, which are consistently tested for adherence.

How should manufacturers think about staffing to deliver this type of cultural change? Typically, we have seen organizations see greatest success by investing early in the following roles:

- Chief digital officer, or equivalent.
- API product manager.
- API developer.
- API security specialist.

Only when the right people are in place, and only then, should organizations look to implement programs, processes, and technology in support of the broader digital platform strategy.

Step 3: Evaluate and build supporting technology

Now comes the fun part: designing your API architecture and building the supporting APIs.

To enable the effective implementation of your API platform, we recommend designing according to the architectural principles of API-led connectivity. This design model allows for IT to more rapidly develop APIs for ecosystem partners consumed by enabling reuse across a supporting set of

internal APIs that developers can use to unlock standardized access to core systems of record.

Once the architecture is defined, the next step is to buy or build a full lifecycle API platform that enables the development and management of your APIs.

Full lifecycle API management can be broken down into the phases listed below:

- Planning and initial design.
- Test-driven development.
- Flexible deployment.
- Secure operation.
- Governance and monetization.
- Analysis and testing.
- Developer engagement.
- Versioning and retirement.

Note that your successful execution of the API lifecycle will depend on the selection and deployment of a comprehensive platform for full lifecycle API management. This is where the business and technical teams will need to collaborate. While the technical team has its own set of concerns to address, the business team must be assured that the chosen solution is capable of supporting the aspirations identified in the digital strategy. For example, if the digital strategy depends on thousands of unknown software developers gaining self-service access to certain APIs, does the management solution automate the provisioning of self-service registration?

From there it's a decision whether to build or buy, and if buy, which vendor to move forward with. This should be informed by a number of business and technical considerations, including:

- **Time to market requirements:** Depending on the needs of the business, organizations may need to prioritize solutions

which allows for the faster development of the initial APIs supporting its platform, as well as the ability to quickly update and version these APIs in response to customer feedback.

- **API availability and uptime:** Depending on how mission-critical your API platform will be in supporting business operations, firms should implement a solution that minimizes downtime.
- **Security considerations:** For organizations in industries like manufacturing which deal with highly sensitive intellectual property, MuleSoft recommends that APIs be secured at multiple levels–through the implementation of individual API policies, edge gateways, as well as via tokenization and encryption of the data flowing in and out of these APIs.

In a vast majority of cases, organizations are not suited to build an API management solutions than it would be building a database management solutions (as opposed to turning to Oracle or MySQL) or their own content management systems (as opposed to using Wordpress or Drupal).



Learn more about why Gartner named MuleSoft's a leader in the 2018 Magic Quadrant for Full Lifecycle API Management.

Step 4: Engage your ecosystem

Many organizations mistakenly take a "if you build it, they will come" approach when building API platforms. Actively marketing your APIs and developing the ecosystem that will consume them is a critical last-mile problem that must be addressed to ensure that your API platform meets the intended business objectives.

For example, manufacturers who implement an internal digital API platform should think about a formalized training and

certification program to enable different LOB IT teams to consume the APIs they have exposed. Once adoption starts to pick up, organizations should implement programs designed to gather feedback on these APIs to iterate on what has been built and improve partner engagement and satisfaction.

Doing so creates a flywheel effect, where greater adoption leads to more feedback, which enables firms to update its API platform to drive even greater adoption of the platform. And since the platform is tightly aligned to business requirements, this creates a secondary flywheel effect: by driving increased business impact, organizations can justify the investment of more people and budget toward accelerating adoption of and engagement with its API platform.

Evolving your internal API platform over time

Ensuring the success of your platform depends on setting objectives for each of the four stages of the API strategy blueprint and then rigorously measuring and monitoring the organization's progress against those goals. Each of the four stages will involve different goals and KPIs, which will be very different from one organization to the next. The exercises of KPI identification, goal-setting and recalibration should be revisited frequently. For example, in response to successes, failures, market conditions, competition, and customer requirements, your digital strategy will be in a cycle of continuous evolution. Different organizations will certainly have different ways of defining success. But if the habit doesn't take root at the beginning of the journey with some goals, it won't bode well for the rest of the journey.



To learn more, view MuleSoft's API Strategy Blueprint: A Proven Path to Building API-Driven Ecosystems.

Building an API platform for manufacturers with MuleSoft Anypoint Platform

MuleSoft's Anypoint Platform was purpose-built to enable the development of an application network through API-led connectivity, and is the leading platform for doing so. It delivers an unmatched combination of capabilities that allow organizations to realize this vision, including:

- **Support for the Full API Lifecycle:** While many solutions in the market focus exclusively on API management, Anypoint Platform supports the full API lifecycle, enabling APIs to be treated like products. Anypoint Platform supports the entire software development life cycle (SDLC) — from designing, collaborating, building, and testing to deploying, publishing, versioning, and retiring APIs. This capability allows manufacturers to better serve customers and realize their vision of creating an ecosystem of buyers, partners, and suppliers.

- **A Unified Platform:** Anypoint Platform provides enterprise-grade connectivity and support for the full API lifecycle on a single platform, eliminating the need to manage multiple products, vendor relationships, and skill sets. Unifying the functionality required to build an application network streamlines development and simplifies application maintenance. Airbus says it is now able to reduce time to market for IT projects from four months down to four to six weeks; and are now targeting two weeks.

- **Security by Design:** With Anypoint Platform, each individual API can be governed using API policies. Anypoint Platform also enables the implementation of edge gateways that allow for the application of global security policies across all APIs. It enables for data flowing through APIs to be encrypted and tokenized, protecting against

man-in-the-middle attacks and other cyber-threats. These security capabilities allow manufacturers to build an open platform that various internal and external teams can consume from without compromising on security.

- **Strategic Partner Ecosystem:** When you partner with MuleSoft, you tap into our Technology Partner ecosystem to fulfill the vision of a connected enterprise. From market leaders in warehouse management to established Enterprise Resource Planning (ERP) companies, MuleSoft has invested in building strategic relationships to help manufacturers better serve customer needs. MuleSoft offers out-of-the-box connectivity and a joint vision for connecting market leading platforms, such as SAP, Oracle, JDA and many more.

With these capabilities in hand, manufacturers can feel well-equipped to capitalize on today's market opportunity, leveraging the power of an API platform to power a faster and more scalable model for delivering a personalized consumer journey across-channels.



To learn more, view MuleSoft's API strategy essentials: A practical guide for winning in the API economy

About MuleSoft

MuleSoft, a Salesforce company

MuleSoft's mission is to help organizations change and innovate faster by making it easy to connect the world's applications, data, and devices. With its API-led approach to connectivity, MuleSoft's market-leading Anypoint Platform™ empowers over 1,600 organizations in approximately 60 countries to build application networks. By unlocking data across the enterprise with application networks, organizations can easily deliver new revenue channels, increase operational efficiency, and create differentiated customer experiences.

For more information, visit **mulesoft.com**